Volume 9, Issue 4, April – 2024 International Journal of Innovative Science and Research Technology
ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24APR624

The Making of Object Recognition Eyeglasses for the Visually Impaired using Image AI

Dr. Julie Ann B. Real[1]; Kal-el Gabriel C. Ceradoy[2]; RJ Leandrei J. Fortuna[3]; Jeileen Roze N. Gallarte[4]; Kyla Nezel S. Soriano[5]; Akirah Faith A. Emperio[6] Nicole Margareth I. Carlos[7]; Dyanna Chrisleen V. Camia[8]
Philippine School Doha, Doha, Qatar

Abstract:- People with visual impairment may face struggles in their daily activities, as these may affect them socially, physically, and psychologically. This study aims to address this problem by utilizing quantitative experimental research to come up with Object Recognition Eyeglasses out of ImageAI. This device aims to assist the visually impaired person by recognizing the object in front of them and giving an audio output of the name of the object. Throughout the testing process, the Object Recognition Eyeglasses showed accuracy in recognizing different objects and their different varieties. It also showed its capability to recognize objects from far distances, with a maximum distance of 45 meters, and its efficiency in delivering a timely recognition and audio output with an average time interval of 1.61 and 0.63 seconds respectively. Based on these results, the Object Recognition Eyeglasses stands as an accurate, efficient, and capable assistive device that can help visually impaired people in their day-to-day lives. However, this device still needs improvement in terms of convenience by using a phone instead and modifying it to not require any internet connection.

Keywords:- *Object Recognition Eyeglasses, Image AI, Visually Impaired, Assistive Device*

I. INTRODUCTION

People who have complications in their eyesight struggle to keep up with uncomplicated tasks that could be done without assistance, yet due to being visually impaired, it has become a challenge that people face. The World Health Organization (2022) reported that there are about a billion people who suffer from moderate to severe distance vision impairment or blindness. Vision loss has effects on the daily lives of a person. Brunes and Heir (2021) stated that personal experiences with fire or explosion, catastrophic incidents at work, home, or in leisure time, exposure to harmful substances, sexual assaults, war-related events, life-threatening diseases or injuries, and severe human suffering all showed significant disparities. Visual impairment has caused individuals to be prone to various challenges every day, such as simply crossing the street, roaming around, or enjoying their time, as they lack the reaction time and ability to recognize approaching dangerous situations. Visually impaired individuals require more assistance, which can cause issues in circumstances where one does not want to feel overly dependent on the other.

In order to alleviate the challenges faced by visually impaired individuals, recent advancements that are embedded in systems and artificial intelligence need development. Thus, devices like smart glasses were manufactured by Google Glass, wherein the detection process is transformed by signaling the visually impaired through an audio alert or vibration (Mukhiddinov& Cho, 2021). These smart glasses can distinguish objects and signals when confronted with various difficulties; however, the smart glasses can only detect at proximity determined by signal strength. Additionally, a device that also functions as an assistive device is a guide cane, which works as a mobility aid to identify objects and employs tapping sounds for echolocation, similar to the companion cane (Hersh, 2015). In contrast, these guide canes are inaccurate and unreliable when it comes to navigating and approaching dangerous areas, and present certain issues for visually impaired people. Similarly, another study presented Object Recognition Glasses with a fusion of Raspberry Pi and Pi camera for intricate facial recognition procedures, including its detection utilizing an ultrasonic sensor, wherein this technology significantly enhanced individuals' quality of life (Dematti et al, 2023). The studies covered various prototypes that provided effective and secure assistance in locating unfamiliar objects and improving their mobility.

The Object Recognition Eyeglasses aims to support visually impaired individuals in safely locating their surroundings and notifying them of visible objects, allowing them to identify the objects they will encounter, preventing accidents such as crossing the street, bumping into objects, or getting lost. This device would help visually impaired people navigate their surroundings while also giving them a sense of independence.

II. RESEARCH QUESTIONS

The objective of this study is to create Object Recognition Eyeglasses for the Visually Impaired out of ImageAI. Specifically, it answers the following questions:

- How accurate is the Object Recognition Eyeglasses in recognizing different objects?;
- What is the maximum distance the Object Recognition Eyeglasses can recognize an object in meters?;
- How long is the time interval of the Object Recognition Eyeglasses between seeing the object and recognizing the object in seconds? and;

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24APR624

- How long is the time interval of the Object Recognition Eyeglasses between recognizing the object and playing the sound of the name of the object?

III. METHODOLOGY

This study used experimental research design to create Object Recognition Eyeglasses utilizing ImageAI. In order to achieve the intended results, one or more independent variables are subject to manipulation of additional independent variables through the use of the experimental research design, a scientific study technique and a scientific study method (Zubair, 2023). The dependent variable in this study is the Object Recognition Eyeglasses, while the independent variable is ImageAI. To provide reliable results and conclusions, this study employed a quantitative approach, measuring and defining variables (Apuke, 2017). It is crucial to collect data using the quantitative technique to comprehend and describe the phenomena under study.

A. Research Locale

The research study was conducted and tested at the school of the researchers in Qatar. The required facilities are present in the school that enabled them to make the Object Recognition Eyeglasses.

B. Data Gathering Procedure

➢ *Below is the Testing Procedure to Measure the Accuracy of the Object Recognition Eyeglasses*

- Prepare 5 samples of 5 different objects.
- Position yourself in front of one of the samples.
- Set-up the stage by placing a white paper that will serve as the background for each object.
- Turn on and activate the Object Recognition Eyeglasses.
- Place the object in front of you.
- Wait till the Object Recognition Eyeglasses is able to recognize the object.
- Note down if the Object Recognition Eyeglasses was able to recognize the object.
- Do the same for all samples of each type of object.

➢ *Below is the Testing Procedure to Measure the Maximum Distance the Object Recognition Eyeglasses can Recognize an Object*

- Prepare the object to be recognized. and a tape measure.
- Position yourself in a large area.
- With the tape measure, measure 10 meters from you to the object to be recognized.
- Turn on and activate the Object Recognition Eyeglasses.
- Wait till the Object Recognition Eyeglasses is able to recognize the object.
- Note down if the Object Recognition Eyeglasses was able to recognize the object.
- Do the same with distances of 20m, 30m, 40m, 45m, and 50m.

➢ *Below is the Testing Procedure to Measure the Time Interval of the Object Recognition Eyeglasses between Seeing the Object and Recognizing the Object*

- Prepare the object to be recognized and a stopwatch.
- Set-up the stage by placing a white paper that will serve as the background for each object.
- Place the object in front of you.
- Cover the camera with a piece of paper.
- Turn on and activate the Object Recognition Eyeglasses.
- Uncover the camera and immediately start the stopwatch.
- Stop the stopwatch once the object has been recognized.
- Do the same for trials 2 and 3.

➢ *Below is the Testing Procedure to Measure the Time Interval of the Object Recognition Eyeglasses between Recognizing the Object and Playing the Sound of the Name of the Object*

- Prepare the object to be recognized and a stopwatch.
- Set-up the stage by placing a white paper that will serve as the background for each object.
- Place the object in front of you.
- Cover the camera with a piece of paper.
- Turn on and activate the Object Recognition Eyeglasses.
- Uncover the camera.
- Start the stopwatch once the object has been recognized.
- Stop the stopwatch once the program has played the sound of the name of the object.
- Do the same for trials 2 and 3.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24APR624

IV. RESULTS

The section shows the results and interpretation of data that were collected from assembling and testing the device.

A. The Accuracy of the Object Recognition Eyeglasses in Recognizing Different Objects

Table 1: The Accuracy of the Object Recognition Eyeglasses

Trial	Object to be Recognized	5 Samples of the Object to be Recognized	Success Rate in %
1st	Bottle	S1: Tall Plastic Bottle S 2: Small Plastic Bottle S3: Blue Water Tumbler S4: Glass Bottle S5: Large Red Tumbler	100%
2nd	Potted Plant	S1: Large White Pot S2: Small White Pot S3: Regular Sized White Pot S4: Small Green Pot S5: Small Glass Pot	100%

The accuracy of the Object Recognition Eyeglasses was tested using different samples of different objects and testing whether it can identify each sample.

The data on Table 1 displayed the percentage of accuracy of the Object Recognition Eyeglasses in identifying the various objects in the vicinity. Each trial has five distinct samples of varying shapes and sorts to determine its correctness with a “YES” response expected in each case. A bottle in the shape of a short plastic bottle, a glass bottle, a flask bottle, or a plastic tumbler is the first example item. A potted plant with varying components served as the second example object. Three various types of cups—a glass cup, a paper cup, and a mug—were included in the third example item. Bicycles of various sizes and sorts make up the fourth example object. The last example item used to evaluate the assistive device's accuracy was a set of colorful keyboards. With a high success rate of ”YES”, the Object Recognition Eyeglasses identified all five sample objects—bottles, cups, potted plants, bicycles, and keyboards—in all of their different shapes and varieties.

Furthermore, related research employed Tensorflow or Python Open pre-training to effectively identify objects using a camera. The smart glasses improved performance in identifying the item in front by 50–60% (Shakkir, 2022). The equipment works well and can enable those who are blind or visually impaired to walk and navigate on their own. Another comparable gadget was made to alert the user. Users of augmented reality smart glasses can have a more remarkable immersive experience thanks to the display or projection system's usage of sensors to track things in view (Koutromanos&Kazakou, 2023). The ABGs' use of sensors lowers the challenges that people who are visually impaired have when doing everyday tasks.

s=sample

B. The Maximum Distance of Recognition of the Object Recognition Eyeglasses:

Table 2: The Maximum Distance of Recognition

Distance	Recognition
10 meters	Yes
20 meters	Yes
30 meters	Yes
40 meters	Yes
45 meters	Yes
50 meters	No

The researchers tested the maximum distance the Object Recognition Eyeglasses can recognize an object by using the same object, in this case, the researchers used a person, and tested whether it can recognize the person at a continuously farther distance.

Table 2 displays the greatest distance that the Object Recognition Eyeglasses can recognize an object in meters. The recognition range was tested at six different distances to ensure accuracy. The distances in the list were accurately computed using a measuring tape as a reference. The AI correctly identified the person in front of the camera at a distance of 10 meters and said "Person." The following distances apply as well: 20, 30, 40, and 45 meters. After testing the AI, the results showed that it could reliably distinguish the person standing in front of the camera at distances ranging from 10m to 45m. At 50m, the AI was unable to identify the person since they were too far away from the camera.

In a similar investigation, accurate photographs were taken at a distance estimated to be between 40 and 150 meters using an ultrasonic sensor, which generates ultrasonic waves and detects their reflections (AlSaid et al., 2019). In a similar vein, a study conducted to determine distance for visually impaired people utilizing object detection used an HQ image camera with a LIDAR sensor to provide high-precision distance measurements with accurate object recognition (Dragne, 2022). Both experiments

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24APR624

demonstrated that the assistive device is efficient and effective.

C. The Time Interval of the Object Recognition Eyeglasses between Seeing an Object and Recognizing it

The time interval of the Object Recognition Eyeglasses was tested between seeing an object and recognizing it by using a stopwatch to measure the time it takes from the moment the Object Recognition Eyeglasses sees the object until the program is able to recognize the object.

Table 3: Time interval of the Object Recognition Eyeglasses between seeing an object and recognizing it

Trial	**1**	**2**	**3**	**Average**
Time interval (in seconds)	1.83 seconds	1.58 seconds	1.41 seconds	1.61 seconds

Table 3 presents the three different trials done from seeing to recognizing the object by the Object Recognition Eyeglasses by using a stopwatch. The average was computed by adding all the results and dividing the sum by the number of trials. Testing with a pair of scissors, the first trial succeeded in seeing and recognizing it with a delay of 1.83 seconds. In the second trial, the camera succeeded; It saw and recognized it with a delay of 1.58 seconds. In the third trial, the camera succeeded; It saw and recognized it with a delay of 1.41 seconds.

According to the results, it took the AI, on average, 1.61 seconds to correctly recognize and identify the name of the object that was given. The three trials demonstrate that there is a time-dependent lag in seeing and identifying the provided object because the AI frequently detects additional objects behind the object that the camera has captured. Another research that used a Raspberry Pi to create object recognition eyewear discovered that the system could identify objects and barriers and warn visually impaired people of impending dangers (Kumar et al., 2019). In a related investigation, the performance of the glasses was evaluated in terms of recognition time using two metrics that demonstrate improving techniques that lead to an improvement in accuracy and time. Elnabawy et al., 2022).

D. The Time Interval of the Object Recognition Eyeglasses between Recognizing the Object and Playing the Sound of its Name

The time interval of the Object Recognition Eyeglasses was tested between recognizing an object to playing the sound of its name by using a stopwatch to measure the time it takes from the moment the Object Recognition Eyeglasses recognizes the object until the program is able to play the sound of its name.

Table 4: Time Interval of the Object Recognition Eyeglasses between Recognizing an Object and Playing the Sound of its Name

Trial	**1**	**2**	**3**	**Average**
Time interval (in seconds)	0.66 seconds	0.68 seconds	0.56 seconds	0.63 seconds

Table 4 depicts the three trials for determining the time interval between recognizing and playing the object's sound using a stopwatch. Three trials were undertaken to determine the data's credibility, and the average was computed by dividing the sum of all values by three. In the first trial, the audio played for an average of 0.66 seconds. In the second trial, the audio played for an average of 0.68 seconds. And lastly the third trial, the audio played in an average of 0.56 seconds.

According to the data, the Object Recognition Eyeglasses took an average of 0.63 seconds to play the audio after detecting an object. The tests revealed that the audio of the Object Recognition Eyeglasses had the smallest latency in playing the sound. To guide the vision impaired, the ImageAIactivates audio and plays it after identifying an object to avoid accidents. The glasses have been shown to translate visuals into audio in 3 seconds. Similarly, many smart glasses systems have Artificial Intelligence that incorporates audio feedback to deliver real-time solutions in navigating, such as a similar program with the use of eSpeak was integrated into the Object Recognition Eyeglasses, wherein the convenience of the audio's speed helps the visually impaired locate objects faster (Islam et al., 2023).

The following is the summary of results for each Statement of the Problem of this study.

➢ *Accuracy of the Object Recognition Glasses in Identifying Objects*

- Five sample objects of varying types and forms were tested, the glasses accurately identified the objects, which resulted in all of the samples being marked as “YES” and a high percentage of success rate.

➢ *Maximum Distance the Object Recognition Glasses can Recognize an Object in Meters*

- The glasses were tested at six distinct distances. Beginning at 10 meters, reaching the maximum distance at 45 meters, and by 50 meters, it could no longer detect the particular object.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24APR624

➢ *Time Interval of the Object Recognition Glasses between Seeing an Object and Recognizing it*

- The glasses were tested in three trials to determine the time interval between seeing and recognizing the object using a stopwatch. On Trials 1, 2, and 3, the glasses recognized the sample object with a delay of 1.83 seconds, 1.58 seconds, and 1.41 seconds, respectively.

➢ *The Time Interval of the Object Recognition Glasses between Recognizing the Object and Playing the Sound of its Name*

- The voice-activated Object Recognition Glasses produced a fast rate of playing audio with a fastest time of 0.56 seconds with a minimum delay of 0.63 seconds in recognizing the object to play the name of the object presented.

V. CONCLUSIONS

➢ *Through the Findings, the Researchers were Led to Make the Following Conclusions:*

- Following the results, the Object Recognition Eyeglasses can recognize different objects effectively and proficiently as the data showed on the sample objects that are close to the prototypes found on the website with a high percentage of success rates. Object Recognition Eyeglasses were able to operate with a camera that functions and results in a clear and accurate representation of objects. However, the assistive device can only recognize objects at 45 meters whereas by 50 meters it can no longer identify objects. To increase the safety of the visually impaired the Eyeglasses displayed timely and quick results with an average minimum delay of 1.61 seconds in recognizing the objects present. Lastly, the assistive device displayed a fast rate upon recognizing an object to announce the object name, obtaining an average minimum delay of 0.63 seconds.
- This study can help the community in adhering to the mission of the school when it comes to being Pro-Environment. In addition, the students and school staff are advised to use higher-grade material to increase results of longevity, detection time, and response time and further investigate to improve the performance of the Object Recognition Eyeglasses.
- The Qatar and Philippine communities are encouraged to use similar materials available to make cost-effective Object Recognition Eyeglasses using ImageAI, which has many helpful functions such as identifying obstacles. The use of audio-operated glasses to efficiently play the sound of the object which is convenient is different case scenarios. The researchers advise the communities to find other materials to improve the program's capabilities and features. Due to the struggles of the visually impaired in navigating their daily lifestyle, they are more prone to be in threatening situations.
- Object Recognition Eyeglasses make people aware of the struggles of the visually impaired encounter. Visually impaired people will have an enhanced and safe lifestyle while doing simple tasks, wherein their quality of life will be improved and at the same time ensure their wellness.
- Moreover, future researchers may use this study to assist in developing a project with similar components. Future researchers may include more detectors and speed in playing the audio. The assistive devices should expand the distance to locate other present objects. The research suggests using a phone instead of a laptop in programming the software to make it more convenient. The research also suggests making the device eliminate the Wi-Fi connection. The ability to focus on the given object instead of recognizing other objects at once can also be further tested. Future researches are also suggested to improve the number of objects that can be recognized due to only recognizing 50 different types of objects.

REFERENCES

[1]. AlSaid, H., AlKhatib, L., AlOraidh, A., AlHaidar, S. & Bashar A. (2019). Deep Learning Assisted Smart Glasses as Educational Aid for Visually Challenged Students. *2019 2nd International Conference on New Trends in Computing Sciences (ICTCS)*, 1-6. https://doi.org/10.1109/ICTCS.2019.8923044

[2]. Apuke, O. (2017). Quantitative research methods : A synopsis approach. *Kuwait Chapter of Arabian Journal of Business and Management Review*, *6*(11), 40–47. https://doi.org/10.12816/0040336

[3]. Brunes, A., & Heir, T. (2021). Serious life events in people with visual impairment versus the general population. *International Journal of Environmental Research and Public Health*, *18*(21), 11536. https://doi.org/10.3390/ijerph18211153

[4]. Dematti, G., Vijaykumar, R., Teggi, A., Naik, L., &Guddadamani, D. (2023). Smart Glasses for Visually Impaired Persons. *4*(12). https://ijrpr.com/uploads/V4ISSUE12/IJRPR20447.pdf

[5]. Dragne, C., Todirite, I., Iliescu. M., &Pandelea, M. (2022). Distance Assessment by Object Detection—For Visually Impaired Assistive Mechatronic System. 12(13). https://doi.org/10.3390/app12136342

[6]. Elnabaway, R., Abdennadher, S., Hellwich, O., &Eldawlatly, S. (2022). Object recognition and localization enhancement in visual prostheses: a real-time mixed reality simulation. 21(91). https://doi.org/10.1186/s12938-022-01059-7

[7]. Hersh, M. (2015). Cane use and late onset visual impairment. *Technology and Disability*, *27*(3), 103–116. https://doi.org/10.3233/TAD-150432

[8]. Islam, R., Akter, S., Iqbal, F., Rahman, S., & Khan, R. (2022). Deep learning-based object detection and surrounding environment description for visually impaired people. 9(6). https://doi.org/10.1016/j.heliyon.2023.e16924

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24APR624

[9]. Koutromanos, G., &Kazakou, G. (2023). Augmented reality smart glasses use and acceptance: A literature review. *2*. https://doi.org/10.1016/j.cexr.2023.10002
[10]. Kumar, S., Varun, K., & Rahman, J. (2019). Object Recognition using perspective glass for the blind/visually impaired. *4*(1). http://doi.org/10.5281/zenodo.2624630
[11]. Mukhiddinov, M. & Cho, J. (2021). Smart Glasses System Using Deep Learning for the Blind and Visually Impaired. *10*(22), 2756. https://doi.org/10.3390/electronics10222756
[12]. Shakkir, M., Shaji, B., Muhsin, M., Aprem, B., & Abhiraj, K. (2022). Virtual Smart Glass for Blind using Object Detection. *10*(10). https://www.ijres.org/papers/Volume-10/Issue-10/1010537544.pdf
[13]. World Health Organization (2022). Blindness and vision impairment. https://www.who.int/news-room/fact-sheets/detail/blindness-and-visual-impairment
[14]. Zubair, A. (2023). Experimental Research Design-types & process. *Academia Open*.